

## PATENT ABSTRACTS OF JAPAN

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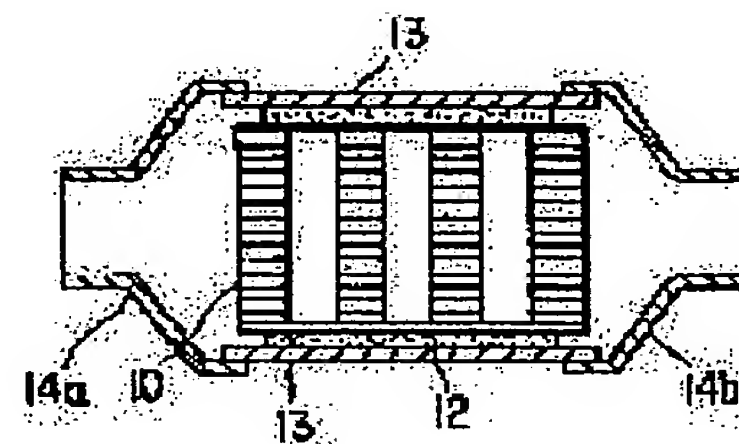
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(54) TANDEM TYPE METAL CARRIER, METHOD AND APPARATUS FOR MAKING THE SAME

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a tandem type metal carrier which can be made relatively simply and has good productivity, temperature increase properties, and durability, and method for making it.

SOLUTION: A tandem type metal carrier is produced by a process in which honeycomb bodies 10 in which the diameters which are formed by a method in which plane metal foil and corrugated foil, which was prepared by machining the plane metal foil, are laid to overlap each other and wound up are equal and the axial length is short (hereafter called short-long honeycomb bodies) are arranged separately in series in the axial direction, and the honeycomb bodies 10 are fixed by covering bodies made of wide plane foil or corrugated foil wound up at least twice on the outermost circumferences of the honeycomb bodies 10. The carrier is set in an outer cylinder, and a non-expandable fiber mat 12 is placed between the covering body and the cylinder.



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## CLAIMS

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### [Claim(s)]

[Claim 1]A diameter which wound in piles metal flat foils and a wave foil which processed this into a waveform, and formed it is equal, And open an interval and honeycomb body (henceforth short long honeycomb body) plurality with short shaft-orientations length is arranged in series to shaft orientations, Fix two or more of these short long honeycomb bodies that carried out series by a covering body which consists of a double-width flat foil or a wave foil made into that outermost periphery two or more rolls, and insert a tandem-die metal honeycomb object of this integral type in an outer case, and between a covering body and an outer case, A tandem-die metal carrier making a non-expanding textiles mat intervene.

[Claim 2]The tandem-die metal carrier according to claim 1 which constitutes the shaft-orientations length of the latest entering-exhaust gas side short long honeycomb body for a long time on the whole among short long honeycomb bodies arranged to a tandem, and is characterized by things.

[Claim 3]Two or more short long honeycomb bodies which are wound around the rolling-up axis of rotation which consists of two pieces of a rate, and are formed mount the 1st spacer on a position which maintains a predetermined interval, enabling free predetermined number attachment and detachment, And a manufacturing installation of a tandem-die metal carrier which installs a side press in an end face position of a short long honeycomb body arranged to the entering [ to exhaust gas ], and appearance side, and is characterized by things.

[Claim 4]Make a tip of a flat foil and a wave foil which plural lines which kept a predetermined interval made put on the axis of rotation which consists of two pieces of a rate mutually bite, and it pinches, Mount on the rolling-up axis of rotation the 1st spacer of a byway which predetermined carries out number-of-turns winding of each flat foil and the wave foil in piles, forms an initial volume object, and is filled with each interval of these first stage volume object, enabling free attachment and detachment, and. Until it carries out the press clamp of the initial volume object end face of a tip and the last end with the 1st side

press of a byway and becomes a target path about a flat foil and a wave foil succeedingly, Make it wind spirally, applying tension to a flat foil, and it forms and ranks second to a minor-axis honeycomb body of a predetermined path, Mount or install [ substitution ] free attachment and detachment of the 2nd spacer of a major diameter on the 1st spacer, and. Mount or install [ substitution ] free attachment and detachment of the 2nd side press of a major diameter on the 1st side press, and the side press of each honeycomb body is carried out, After arranging the honeycomb body end face, releasing said side press and removing the 1st and 2nd spacer, After making the edge of a flat foil and a wave foil of each honeycomb body periphery fix, fixing two or more roll winding and its edge for a short long honeycomb body periphery of an equal diameter arranged to two or more series by a broad flat foil or a wave foil and forming a covering body, A manufacturing method of a tandem-die metal carrier removing the 1st side press and the rolling-up axis of rotation.

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[Translation done.]

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention]In the catalytic converter used for purification of engine exhaust gas, such as a car, this invention relates to the tandem-die metal carrier which has arranged the honeycomb body which supports a catalyst in the shape of a tandem, its manufacturing installation, and its manufacturing method.

[0002]

[Description of the Prior Art]Conventionally, a metal carrier is made cover lamination for the wave foil which carried out wave attachment processing of a heat-resistant metal flat foil and this flat foil, and cover a heat-resistant mat for the metal honeycomb object which was wound spirally and formed on a periphery, or not to cover, is inserted in the outer cases of heat-resistant metal, carries out diametral shrinkage machining of the outer case as occasion demands, and is manufactured. The common-wave foil and honeycomb body, and outer case of this honeycomb body are joined by methods, such as a filter medium or diffusion treatment, and wash coating and catalyst support are performed further.

[0003]When using the metal carrier which consists of such one honeycomb body for a waste gas system, the temperature up of a honeycomb body does not fully accomplish at the time of engine start, but the case where activation of a catalyst is overdue arises. Namely, in this seed honeycomb body, since calorific capacity is high, in the central part where an exhaust gas flow rate becomes [ many ] and temperature becomes high, and its neighborhood, temperature up is performed early and also activates activity of a catalyst in connection with it, but. When it becomes close to the peripheral part of a honeycomb body, the heating rate of a honeycomb body may be slow, therefore a catalysis cannot fully be demonstrated, but raw gas may pass as it is.

[0004]It is good to divide a honeycomb body into small calorific capacity, or to make emission into a turbulent flow, in order to solve such a problem, and the metal carrier of the tandem die which provides a gap and arranges in series the small calorific capacity honeycomb body divided in order to realize this is proposed.

[0005]For example, single type metal carrier a which built the metal honeycomb object 1a into the tubed outer case 2a as shown in drawing 5, The gap 3 is held for single type metal carrier b which built the metal honeycomb object 1b into tubed outer case 2b between honeycomb body 1a-1b, each outer case end is carried out junction 4 by welding or other means, and the metal carrier of a tandem die is constituted. Not only two pieces but the method which does not join outer cases directly but is joined using a sleeve can adopt a tandem-die metal carrier like a graphic display (refer to JP,6-254409,A and JP,6-288232,A). However, this carrier has the problem that productivity is low, in order to manufacture separately two or more single type metal carriers, respectively and to join each. Since the honeycomb has joined to the outer case directly, there is a cooling loss (radiation loss), the temperature gradient between that purification performance is inferior and an outer case-honeycomb occurs, and there is also a problem that endurance is inferior.

[0006]As shown in drawing 6, the metal honeycomb objects 1c and 1d of a couple in the outer case 2c. The gap 3 is provided and inserted in between the honeycomb body 1c and 1d, and the metal carrier of the tandem die which carries out low junction and forms the outer case 2c and the honeycomb bodies 1c and 1d by the entrance side of 1 d of honeycomb bodies of the downstream is indicated by JP,5-195763,A. The process whose diameter is reduced after this tandem-die metal carrier's also manufacturing each honeycomb body separately, pressing each honeycomb body fit in an outer case or putting into an outer case is taken, and there is a problem in productivity. There is also a problem in which the same purification performance and endurance as the above are inferior.

[0007]As furthermore shown in drawing 7, join the metal honeycomb object 1f of the downstream to the outer case 2d, and. JP,5-83315,U and JP,5-83316,U are shown the metal carrier of the tandem die which makes the retainer 5 joined to the outer case 2d so that it might have the gap 3 support the metal honeycomb object 1e of the upstream, and constitutes it. Besides having the same manufacturing technical problem as drawing 6 which also mentioned above this tandem-die metal carrier, the joining process of a retainer is needed and a manufacturing process is still more complicated. Even if the problem of the purification performance and endurance which described the carrier of the upstream above is solvable, the carrier of the downstream has the same problem. Therefore, the tandem-die metal carrier compatible in productivity, endurance, and purification performance did not result in utilization.

[0008]

[Problem(s) to be Solved by the Invention]This invention solves the above-mentioned conventional problem. The purpose is excellent in the productivity which can be manufactured comparatively simply, and it is providing the tandem-die metal carrier which has the outstanding heating characteristic and endurance, its manufacturing installation, and its manufacturing method.

[0009]



[Means for Solving the Problem]To achieve the above objects, this invention makes the following composition a gist.

(1) A diameter which wound in piles metal flat foils and a wave foil which processed this into a waveform, and formed it is equal, And open an interval and honeycomb body (henceforth short long honeycomb body) plurality with short shaft-orientations length is arranged in series to shaft orientations, Fix two or more of these short long honeycomb bodies that carried out series by a covering body which consists of a double-width flat foil or a wave foil made into that outermost periphery two or more rolls, and insert a tandem-die metal honeycomb object of this integral type in an outer case, and between a covering body and an outer case, A tandem-die metal carrier making a non-expanding textiles mat intervene.

[0010](2) The above (1) which constitutes the shaft-orientations length of the latest entering-exhaust gas side short long honeycomb body for a long time on the whole among short long honeycomb bodies arranged to a tandem, and is characterized by things Tandem-die metal carrier of a statement.

(3) Two or more short long honeycomb bodies which are wound around the rolling-up axis of rotation which consists of two pieces of a rate, and are formed mount the 1st spacer on a position which maintains a predetermined interval, enabling free predetermined number attachment and detachment, And a manufacturing installation of a tandem-die metal carrier which installs a side press in an end face position of a short long honeycomb body arranged to the entering [ to exhaust gas ], and appearance side, and is characterized by things.

[0011](4) Make a tip of a flat foil and a wave foil which plural lines which kept a predetermined interval made put on the axis of rotation which consists of two pieces of a rate mutually bite, and it pinches, Mount on the rolling-up axis of rotation the 1st spacer of a byway which predetermined carries out number-of-turns winding of each flat foil and the wave foil in piles, forms an initial volume object, and is filled with each interval of these first stage volume object, enabling free attachment and detachment, and. Until it carries out the press clamp of the initial volume object end face of a tip and the last end with the 1st side press of a byway and becomes a target path about a flat foil and a wave foil succeedingly, Make it wind spirally, applying tension to a flat foil, and it forms and ranks second to a minor-axis honeycomb body of a predetermined path, Mount or install [ substitution ] free attachment and detachment of the 2nd spacer of a major diameter on the 1st spacer, and. Mount or install [ substitution ] free attachment and detachment of the 2nd side press of a major diameter on the 1st side press, and the side press of each honeycomb body is carried out, After arranging the honeycomb body end face, releasing the 2nd side press and removing the 1st and 2nd spacer, After making the edge of a flat foil and a wave foil of each honeycomb body periphery fix, fixing two or more roll winding and its edge for a short long honeycomb body periphery of an equal diameter arranged to two or more series by a broad flat foil or a wave foil and forming a covering body, A manufacturing method of a

tandem-die metal carrier removing the 1st side press and the rolling-up axis of rotation.

[0012]

[A mode of implementation of an invention] This invention is explained in detail based on figures below. Drawing 1 shows an example of basic constitution of a metal carrier which consists of a tandem honeycomb body of this invention. Namely, wind spirally in piles the small metal flat foils which have a heatproof and corrosion resistance, and a wave foil which processed this flat foil wavelike, and the honeycomb body 10 with the small length of shaft orientations (in this invention, it is called an expedient top) is formed, In series, form the gap s between each honeycomb body, and the honeycomb body plurality 10a, 10b-10n of this equal diameter is arranged, By covering a periphery of each honeycomb body 10 with the covering body 11 which winds a broad flat foil of one sheet, or several [ 1 thru/or ] wave foils, and forms them, and fixing, an integral-type tandem metal honeycomb object is used.

[0013]Although shaft-orientations length L in particular of the short long honeycomb body 10 does not limit, since a temperature change of temperature up and a temperature fall becomes intense, the honeycomb body 10a which what is necessary is just to decide suitably in consideration of the number of honeycomb bodies to arrange, and is arranged especially to an entering-exhaust gas side has remarkable degradation of a catalyst supported by carrier. Therefore, it is preferred to choose a size (capacity, i.e., length) which does not cause catalyst de-activation in particular. Although the length of the gap s is also determined suitably, since it is ineffective if not much narrow, not less than 5-mm the thing set to about less than 25 mm is preferred. Since a honeycomb body shortens shaft-orientations length and is insulated with a non-expanding mat, bring forward heat transfer which calorific capacity can be made small and can be set radially, and. Since a gas stream of rectification which came out of a honeycomb body turns into abouchement, temperature averaging is carried out in a gap s portion provided between honeycomb bodies, it flows into the following honeycomb body and this is heated uniform, can equalize initial heating at the time of engine start at an early stage especially, and. Since a temperature gradient is not made in a honeycomb, the endurance of a honeycomb body improves.

[0014]Drawing 2 is what shows a section in the state where the integral-type tandem honeycomb body 10 shown in drawing 1 was included in a casing, It covers with a mat which becomes a periphery of the honeycomb body 10 from ceramic fiber, such as the non-expanding textiles mat 12, for example, alumina etc., It carries out whether the diameter of a casing which inserted namely, pressed this fit in a casing or the outer case 13 (henceforth a casing), or inserted a honeycomb body is reduced, and a honeycomb body is supported by proper planar pressure via a mat. The inside 14a and 14b of a figure is a reducer which joins one end to the casing 13 and connects the other end to an exhaust gas lead pipe of order. A flange (not shown) may be provided in order to connect with an exhaust gas lead pipe at the other end.

[0015]The above-mentioned tandem honeycomb body 10 is manufactured by drawing 3

and a means shown in an example of 4. As shown in drawing 3, the central rolling-up axis of rotation 15 is formed in the middle by the two pieces 15a and 15b of a rate which have a slit, An interval of length L of the short long honeycomb body 10 formed in pars intermedia of this axis of rotation is opened, Mounting immobilization of two or more (16a, 16b) 1st spacer 16 with length (width) which has 16 s of axial inserting grooves drilled from a periphery to the central part, and constitutes the interval s of a tandem honeycomb body is carried out, It has structure which can install the 1st side presses 17a and 17b in a both-ends position of a tandem honeycomb body, and can carry out the side clamp of the honeycomb body to it.

[0016]Opening a predetermined interval, carrying out positioning guide (not shown) introduction, and making a slit of the axis of rotation 15 bite a tip of the flat foil 18 of plural lines, and the wave foil 19 first, in order to form the tandem honeycomb body 10. After mounting on the 1st spacer 16a and 16b between initial volume object 10a' which was made to rotate the axis of rotation 15, was rolled the first stage, was carried out (2-5 rolls), and was formed, 10b', and 10c', the side of initial volume object 10a' and 10c' is clamped and restrained with the 1st side presses 17a and 17b installed in both sides. As spirally shown in winding and drawing 4, use the flat foil 18 and the wave foil 19 as the honeycomb bodies 10a, 10b, and 10c which reached a target path succeedingly, applying tension to a flat foil, and at this time. Insert and mount each 1st spacer and the 2nd spacer 20a and 20b of a major diameter which has 20 s of the 1st spacer insertion grooves. After forming the 2nd side presses 21a and 21b which wrap the 1st side press entirely, carrying out a side press with this press and arranging the end face of each honeycomb body, the 2nd and 1st press and the 2nd and 1st spacer are removed.

[0017]The Shache cut of a flat foil and the wave foil is carried out holding composition of a formed short long honeycomb body in this way, and the temporary stop of the trailer is carried out by spot welding etc. Subsequently, a double-width (it has the width which wraps each short long honeycomb body entirely) flat foil or a wave foil is introduced, After carrying out the temporary stop of the tip to a periphery of each honeycomb body by spot welding etc. and carrying out two or more roll (2-5 rolls) winding by non-tension, the Shache cut is carried out, the edge is joined to a winding periphery, the covering body 11 is formed, and it unites with each honeycomb body. By drawing out a split piece which constitutes the rolling-up axis of rotation 15 in the appropriate back, a metal carrier which has arranged a short long honeycomb body of an equal diameter to two or more tandems can be manufactured.

[0018]The length of shaft orientations of each honeycomb body and an interval of a honeycomb body can be freely adjusted to the purpose size made profitably like, and should just also choose width of a spacer according to it.

[0019]

[Example]

[Example 1] The integral-type tandem-die metal carrier which set a short long honeycomb



body 90 mm in diameter and 20 mm in length to 5 mm, and established the five crevices S between each short long honeycomb body for it continuously was produced. Common and the wave foil material which constitute a honeycomb body depended junction on diffusion bonding technique using the ferrite series stainless steel of 50 micrometers of \*\*\*\*\*. The thing of 6-mm thickness was used for the mat made to intervene between an outer case casing and a honeycomb body, it reduced the diameter of this with the outer case, and compressed it into 4 mm. As for the outer case casing, the diameter of a thing 105 mm in diameter was reduced by 101 mm.

[0020][Example 2] The same integral-type metal carrier as Example 1 was manufactured. However, only the thickness of the flat foil of a honeycomb body and the wave foil was 30 micrometers.

[0021][Comparative example 1] The metal carrier of the conventional type which inserted a honeycomb body 90 mm in diameter and 120 mm in length in the outer case by 50-micrometer-thick foil material without using a mat material was manufactured. Junction of the honeycomb body was based on diffusion bonding technique.

[0022][Comparative example 2] Others all manufactured the metal carrier by the same method as Example 1 using a long single type metal honeycomb object 90 mm in diameter, and 120 mm in length.

[0023]The metal carrier manufactured according to each above-mentioned example and a comparative example was attached to the engine with a displacement of 3000 cc, and HC purifying performance (BAG1) was investigated. The heat-cold durability test in 900 \*\* of exhaust gas was carried out with the engine. A result is expressed to Table 1.

[0024]

[Table 1]

	H C 浄化性能 (BAG1) 浄 化 率	耐 久 評 価
実施例 1	2 9 %	9 0 0 サイクル合格 ハニカム損傷なし
実施例 2	3 7 %	9 0 0 サイクル合格 ハニカム損傷なし
比較例 1	1 3 %	9 0 0 サイクル合格 ハニカム損傷なし
比較例 2	1 7 %	4 0 0 サイクル不合格 ハニカム内でキレツ 発生し、ずれた

[0025]

[Effect of the Invention]As mentioned above, the tandem-die metal carrier of this invention which has arranged to series two or more short long honeycomb bodies which have desired size, The structure as a tandem die is very simple, and since each honeycomb body is unified, the nest to a casing also has the unnecessary work of positioning etc., And since each honeycomb body can be simultaneously manufactured at one process, productivity can manufacture very highly and cheaply, and. Since the above-mentioned honeycomb body is held on the non-expanding mat, there is no radiation loss and it excels in purification performance compared with other tandem-die metal carriers, and since there is no temperature gradient within a honeycomb body and it is equalized, it excels also in the endurance of a honeycomb body.

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[Translation done.]

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1]The sectional view showing an example of the tandem-die honeycomb body of this invention.

[Drawing 2]The sectional view showing an example of the catalytic converter incorporating the tandem-die honeycomb body of this invention.

[Drawing 3]It is a figure explaining an example of the manufacturing method of this invention, and the outline of equipment, (b), and (c) of (a) are partial explanatory views.

[Drawing 4]It is a figure explaining an example of the manufacturing method of this invention advanced from drawing 3, and (a) is an outline of equipment and (b) is a front view of a spacer.

[Drawing 5]The manufacture explanatory view of the conventional metal carrier.

[Drawing 6]The manufacture explanatory view of other conventional metal carriers.

[Drawing 7]The explanatory view of another conventional metal carrier.

[Description of Notations]

10 : short long honeycomb body

11 : covering body

12 : inexpandible textiles mat

13 : casing

14 : reducer

15 : axis of rotation

16 : the 1st spacer

16 s: Axial inserting grooves

17 : the 1st side press

17 s: Axial inserting grooves

18 : flat foil

19 : wave foil

20 : the 2nd spacer

20 s: The 1st spacer inserting grooves

21 : the 2nd side press

21 s: The 1st side press inserting grooves

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[Translation done.]



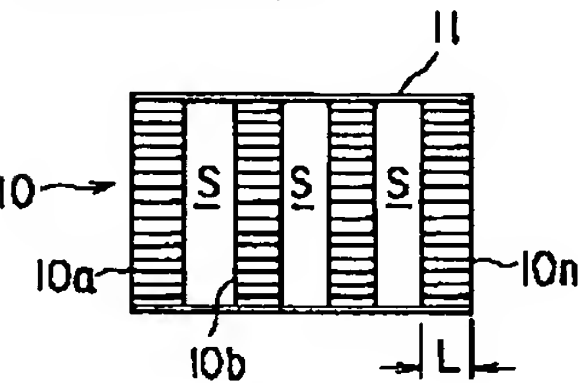
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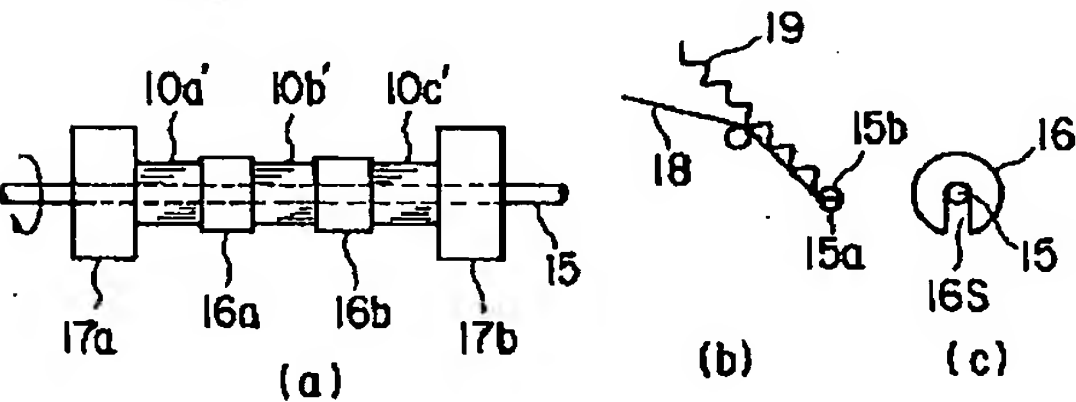
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DRAWINGS

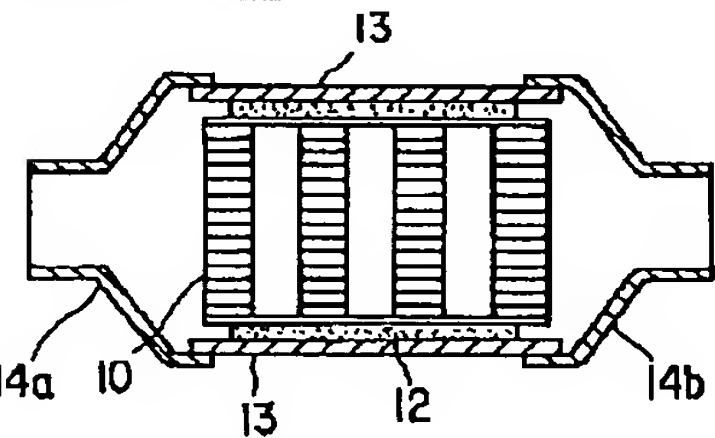
[Drawing 1]



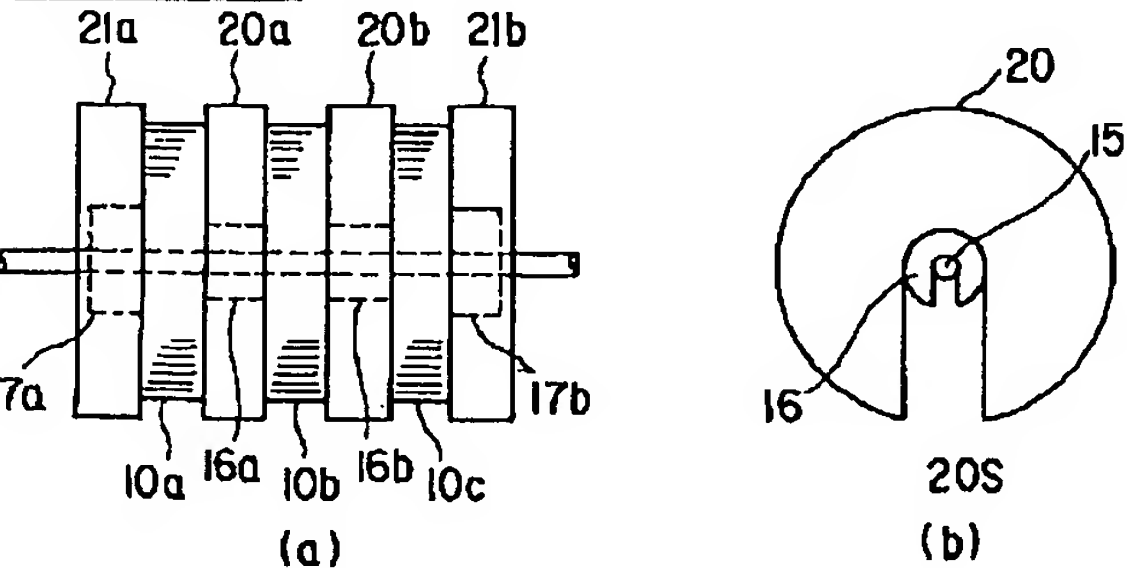
[Drawing 3]



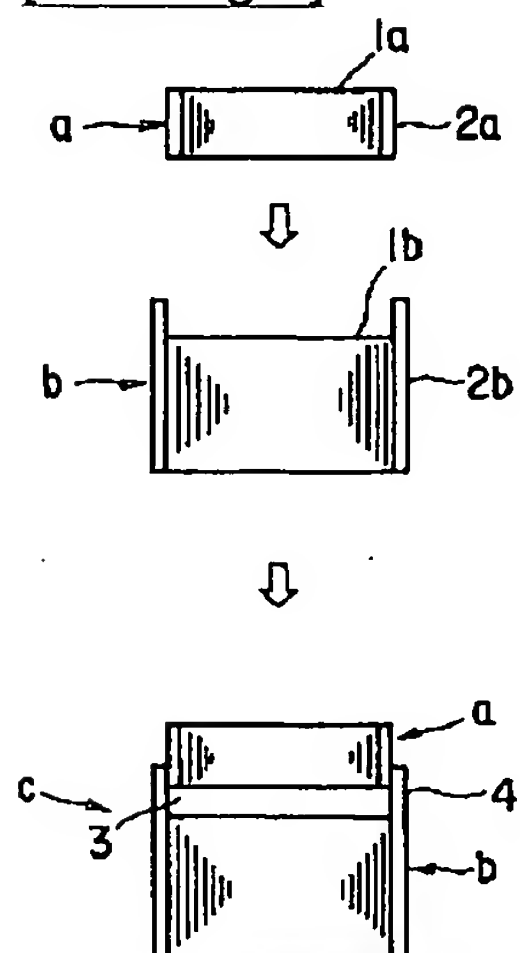
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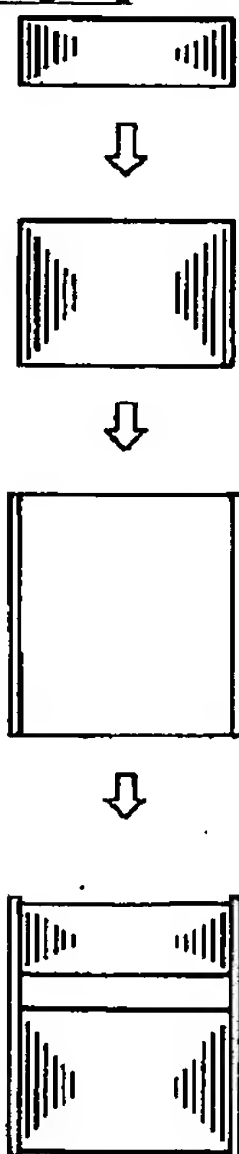
[Drawing 4]



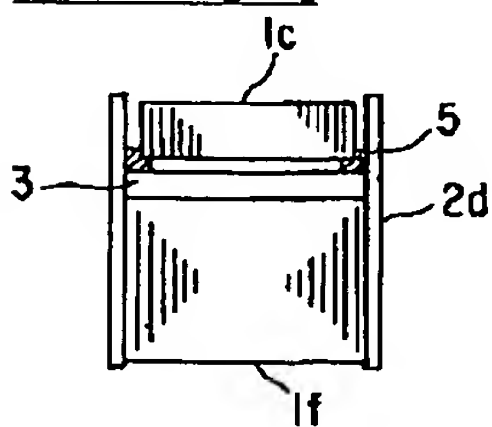
[Drawing 5]



[Drawing 6]



[Drawing 7]



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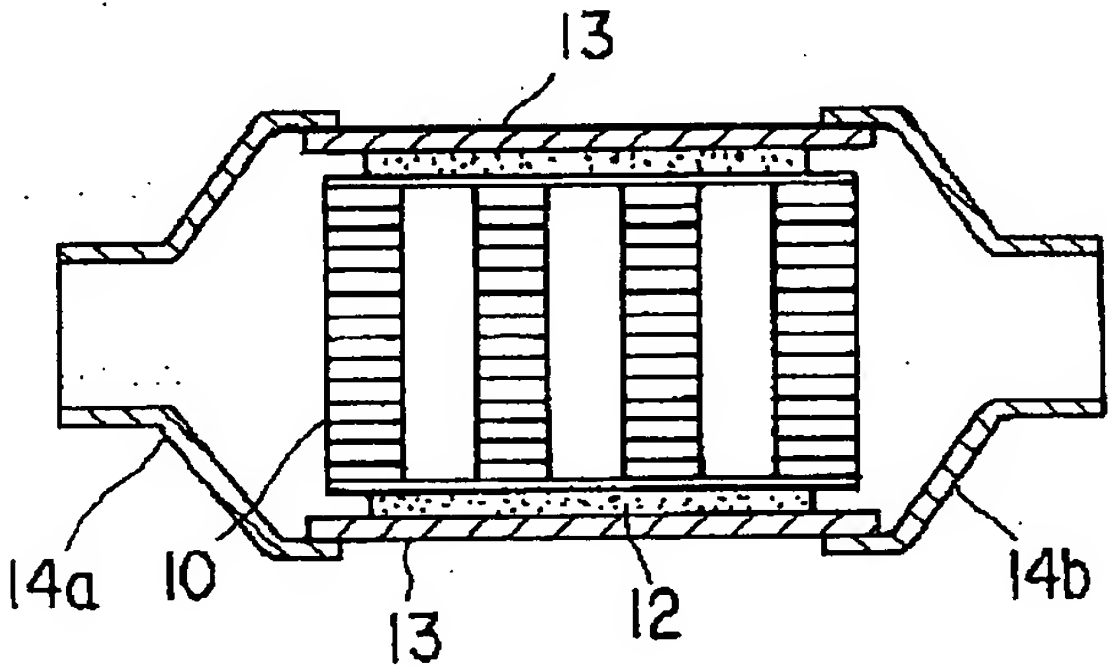
弁理士 田村 弘明

(54)【発明の名称】 タンデム型メタル担体及びその製造装置並びにその製造方法

(57)【要約】

【課題】 本発明は比較的簡易に製造できて生産性に優れると共に、優れた昇温特性及び耐久性を有するタンデム型メタル担体並びにその製造方法を提供する。

【解決手段】 金属製平箔と、これを波形に加工した波箔とを重ねて巻回して形成した直径が等しく、かつ軸方向長さの短いハニカム体（以下短長ハニカム体という）複数個を間隔をあけて軸方向に直列に配置し、この直列した複数の短長ハニカム体を、その最外周に複数巻きした広幅の平箔または波箔よりなる外被体で固定してなる。そして、該タンデム型メタル担体を外筒に装入し、外被体と外筒との間に非膨脹性繊維マットを介在せしめたタンデム型メタル担体。



## 【特許請求の範囲】

【請求項1】 金属製平箔と、これを波形に加工した波箔とを重ねて巻回して形成した直径が等しく、かつ軸方向長さの短いハニカム体（以下短長ハニカム体という）複数個を間隔をあけて軸方向に直列に配置し、この直列した複数の短長ハニカム体を、その最外周に複数巻きした広幅の平箔または波箔よりなる外被体で固定し、かつ該一体型のタンデム型金属ハニカム体を外筒に装入し、外被体と外筒との間に、非膨脹性繊維マットを介在せしめたことを特徴とするタンデム型金属担体。

【請求項2】 タンデムに配列した短長ハニカム体のうち、排ガス入り側最先端の短長ハニカム体の軸方向長さを総体的に長く構成してなることを特徴とする請求項1記載のタンデム型金属担体。

【請求項3】 2つの割片からなる巻取回転軸に、巻回して形成する複数の短長ハニカム体が所定の間隔を保つ位置に第1スペーサーを所定数着脱自在に跨設し、かつ排ガスの入り側及び出側に配置する短長ハニカム体の端面位置にサイドプレスを設置してなることを特徴とするタンデム型金属担体の製造装置。

【請求項4】 2つの割片からなる回転軸に、所定の間隔を置いた複数列の重ね合わせた平箔及び波箔の先端を噛み込ませて挟持し、各平箔及び波箔を重ねて所定の巻数巻回して初期巻き体を形成し、これら初期巻き体のそれぞれの間隔を充填する小径の第1スペーサーを巻取回転軸に着脱自在に跨設すると共に、最先端及び最後端の初期巻き体端面を小径の第1サイドプレスで押圧クランプし、引き続き平箔及び波箔を目標の径になるまで、平箔に張力を掛けながら渦巻状に巻回せしめて、所定の径の短長ハニカム体に形成し、次いで、大径の第2スペーサーを着脱自在に第1スペーサー上に跨設或いは置換設置すると共に、大径の第2サイドプレスを着脱自在に第1サイドプレス上に跨設或いは置換設置して各ハニカム体を側面プレスし、ハニカム体端面を揃えたのち、前記サイドプレスを解放し、かつ第1、第2スペーサーを取り外してから、各ハニカム体外周の平箔と波箔の端縁を固定せしめ、複数の直列に配置している同径の短長ハニカム体外周を幅広の平箔或いは波箔で複数巻き巻回し、その端縁を固定して外被体を形成した後、第1サイドプレス及び巻取回転軸を除去することを特徴とするタンデム型金属担体の製造方法。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】 本発明は自動車等のエンジン排ガスの浄化のために用いる触媒コンバータにおいて、触媒を担持するハニカム体をタンデム状に配置したタンデム型金属担体及びその製造装置並びにその製造方法に関するものである。

## 【0002】

【従来の技術】 従来金属担体は、耐熱金属製平箔とこ

の平箔を波付け加工した波箔とを積層、或いは渦巻状に巻回して形成した金属ハニカム体を、外周に耐熱マットを被覆し或いは被覆せずして耐熱金属製の外筒に装入し、必要により外筒を縮径加工して製作される。このハニカム体の平波箔及びハニカム体と外筒とはろう材或いは拡散処理等の方法で接合され、さらにウオッシュコーティングや触媒担持が行われる。

【0003】 このような一つのハニカム体からなる金属担体を排ガス系に使用する場合、エンジン始動時にハニカム体の昇温が十分に成されず、触媒の活性化が遅れる場合が生じる。すなわち、この種ハニカム体では熱容量が高いため、排ガス流量が多く温度が高くなる中心部及びその近傍では昇温が早く行われ、それに伴って触媒の活動も活発化するが、ハニカム体の外周部分に近くなるとハニカム体の昇温速度が遅く、従って触媒作用を十分に発揮できず、生ガスがそのまま通過してしまうことがある。

【0004】 このような問題を解決するために、ハニカム体を小熱容量に分割したり排ガス流を乱流にすることがよく、これを実現するために分割した小熱容量ハニカム体を間隙を設けて直列に配置するタンデム型の金属担体が提案されている。

【0005】 例えば図5に示すように、金属ハニカム体1aを筒状の外筒2aに組み込んだシングル型金属担体aと、金属ハニカム体1bを筒状の外筒2bに組み込んだシングル型金属担体bとを、ハニカム体1a-1b間に間隙3を保持してそれぞれの外筒端部を溶接等の手段で接合4してタンデム型の金属担体を構成している。タンデム型金属担体は図示のごとく2個に限らず、また外筒同士を直接接合するのではなく、スリーブを用いて接合する方法も採用できる（特開平6-254409号公報、特開平6-288232号公報参照）。しかし、この担体はシングル型金属担体をそれぞれ別個に複数個製造し、かつそれぞれを接合するために生産性が低いという問題がある。また、外筒とハニカムが直接接合しているために放熱ロス（放熱ロス）があって、浄化性能が劣ること、及び外筒-ハニカム間の温度差が発生し、耐久性が劣るという問題もある。

【0006】 また、図6に示すように、一対の金属ハニカム体1c、1dを外筒2cに、ハニカム体1c、1d間に間隙3を設けて装入し、外筒2cとハニカム体1c、1dを下流側のハニカム体1dの入口側でろう接合して形成するタンデム型の金属担体が特開平5-195763号公報に開示されている。このタンデム型金属担体でも各ハニカム体を別個に製造し、また各ハニカム体は外筒に圧入し、或いは外筒に入れた後に縮径する工程がとられ、生産性に問題がある。また、前記と同様の浄化性能及び耐久性が劣る問題もある。

【0007】 さらに図7に示すように、下流側の金属ハニカム体1fを外筒2dに接合すると共に、上流側の



メタルハニカム体1 eを間隙3を有するように外筒2 dに接合したリテーナー5に支持させて構成するタンデム型のメタル担体の実開平5-83315号公報及び実開平5-83316号公報に提示されている。このタンデム型メタル担体でも上述した図6と同じ製造上の課題をもつ以外に、さらに、リテーナーの接合工程が必要となり、製造工程が複雑である。また、上流側の担体は、前記した浄化性能及び耐久性の問題は解決できても、下流側の担体は同様の問題をかかえている。よって、生産性及び耐久性・浄化性能を両立できるタンデム型メタル担体は実用化に至らなかった。

#### 【0008】

【発明が解決しようとする課題】本発明は上記した従来の問題を解消するものであって、比較的簡易に製造できる生産性に優れると共に、優れた昇温特性及び耐久性を有するタンデム型メタル担体及びその製造装置並びにその製造方法を提供することを目的とする。

#### 【0009】

【課題を解決するための手段】上記目的を達成するために本発明は、以下の構成を要旨とする。

(1) 金属製平箔と、これを波形に加工した波箔とを重ねて巻回して形成した直径が等しく、かつ軸方向長さの短いハニカム体（以下短長ハニカム体という）複数個を間隔をあけて軸方向に直列に配置し、この直列した複数の短長ハニカム体を、その最外周に複数巻きした広幅の平箔または波箔よりなる外被体で固定し、かつ該一体型のタンデム型メタルハニカム体を外筒に装入し、外被体と外筒との間に、非膨脹性繊維マットを介在せしめたことを特徴とするタンデム型メタル担体。

【0010】(2) タンデムに配列した短長ハニカム体のうち、排ガス入り側最先端の短長ハニカム体の軸方向長さを総体的に長く構成してなることを特徴とする前記

(1) 記載のタンデム型メタル担体。

(3) 2つの割片からなる巻取回転軸に、巻回して形成する複数の短長ハニカム体が所定の間隔を保つ位置に第1スペーサーを所定数着脱自在に跨設し、かつ排ガスの入り側及び出側に配置する短長ハニカム体の端面位置にサイドプレスを設置してなることを特徴とするタンデム型メタル担体の製造装置。

【0011】(4) 2つの割片からなる回転軸に、所定の間隔を置いた複数列の重ね合わせた平箔及び波箔の先端を噛み込ませて挟持し、各平箔及び波箔を重ねて所定の巻数巻回して初期巻き体を形成し、これら初期巻き体のそれぞれの間隔を充填する小径の第1スペーサーを巻取回転軸に着脱自在に跨設すると共に、最先端及び最後端の初期巻き体端面を小径の第1サイドプレスで押圧クランプし、引き続き平箔及び波箔を目標の径になるまで、平箔に張力を掛けながら渦巻状に巻回せしめて、所定の径の短径ハニカム体に形成し、次いで、大径の第2スペーサーを着脱自在に第1スペーサー上に跨設或いは置換

設置すると共に、大径の第2サイドプレスを着脱自在に第1サイドプレス上に跨設或いは置換設置して各ハニカム体を側面プレスし、ハニカム体端面を揃えたのち、第2サイドプレスを解放し、かつ第1、第2スペーサーを取り外してから、各ハニカム体外周の平箔と波箔の端縁を固定せしめ、複数の直列に配置している同径の短長ハニカム体外周を幅広の平箔或いは波箔で複数巻き巻回し、その端縁を固定して外被体を形成した後、第1サイドプレス及び巻取回転軸を除去することを特徴とするタンデム型メタル担体の製造方法。

#### 【0012】

【発明の実施の態様】以下本発明を図に基づいて詳細に説明する。図1は本発明のタンデムハニカム体よりなるメタル担体の基本構成の例を示すものである。すなわち、耐熱・耐食性を有する小幅の金属製平箔と、この平箔を波状に加工した波箔とを重ねて渦巻状に巻回して軸方向の長さの小さいハニカム体（本発明では便宜上という）10を形成し、この同径のハニカム体複数個10 a, 10 b ~ 10 nを直列にかつ夫々のハニカム体間に間隙sを設けて配置し、各ハニカム体10の外周を一枚の幅広平箔または波箔を1乃至数巻き巻回して形成する外被体11で被覆し固定することで、一体型のタンデムメタルハニカム体にする。

【0013】短長ハニカム体10の軸方向長さLは、特に限定しないが、配置するハニカム体の数を考慮し適宜決めればよく、特に排ガス入り側に配置するハニカム体10 aは昇温と降温の温度変化が激しくなるため、担体に担持された触媒の劣化が著しい。よって特に、触媒劣化を起こさないような大きさ（容量、すなわち長さ）を選ぶことが好ましい。また、間隙sの長さも適宜に決定されるが、余り狭いと効果がないので、5mm以上25mm未満程度とすることが好ましい。ハニカム体は軸方向長さを短くし、かつ、非膨脹マットで断熱されるため、熱容量を小さくでき、半径方向における熱伝達を早めると共に、ハニカム体間に設けた間隙s部分でハニカム体から出た整流のガス流が混流となって均温化され、次のハニカム体に流れ、これをムラなく加熱するため、特にエンジン始動時の初期加熱を早期に均一化できると共に、ハニカム内に温度差ができないため、ハニカム体の耐久性が向上する。

【0014】図2は図1に示した一体型のタンデムハニカム体10をケーシングに組み込んだ状態の断面を示すものであって、ハニカム体10の外周には非膨脹性繊維マット12、例えばアルミナ等のセラミック繊維からなるマットで被覆し、これをケーシング或いは外筒13（以下ケーシングと云う）に挿入、すなわち圧入するか、ハニカム体を挿入したケーシングを縮径するかして、マットを介してハニカム体を適宜の面圧で支持する。図中14 a, 14 bは一端をケーシング13に接合し、他端を前後の排ガス導管に接続するレジューサであ

る。その他端には排ガス導管に接続するためにフランジ（図示せず）を設けてもよい。

【0015】上記したタンデムハニカム体10は図3、4の例に示す手段で製造する。図3に示すように、中心の巻取回転軸15を中間にスリットを有する2つの割片15a、15bで形成し、該回転軸の中間部に、形成する短長ハニカム体10の長さLの間隔をあけて、外周から中心部まで穿設した軸挿通溝16sを有し、かつタンデムハニカム体の間隔sを構成する長さ（幅）を持った第1スペーサー16を複数個（16a、16b）跨設固定し、また、タンデムハニカム体の両端部位置に、第1サイドプレス17a、17bを設置してハニカム体を側面クランプすることができる構造となっている。

【0016】タンデムハニカム体10を形成するには、まず、回転軸15のスリットに複数列の平箔18及び波箔19の先端を、所定の間隔をあけて位置決めガイド

（図示せず）導入して噛み込ませながら、回転軸15を回転させて初期巻きし（2～5巻き）、形成した初期巻き体10a'、10b'、10c'間に第1スペーサー16a、16bに跨設した後、両サイドに設置した第1サイドプレス17a、17bで初期巻き体10a'、10c'の側面をクランプして拘束する。引き続いて平箔18と波箔19を平箔に張力をかけながら渦巻状に巻回し、図4に示すように、目標の径に達したハニカム体10a、10b、10cとし、この時点で、第1スペーサー挿入溝20sを有する大径の第2スペーサー20a、20bを、夫々の第1スペーサーを挿入して跨設すると共に、第1サイドプレスを被包する第2サイドプレス21a、21bを設けて該プレスにて側面プレスし、各ハニカム体の端面を揃えた後、第2、第1プレス、及び第2、第1スペーサーを取り外す。

【0017】かくして、形成した短長ハニカム体の構成を保持しながら平箔及び波箔をシャーカットし、その終端部をスポット溶接等で仮止めする。次いで、広幅（各短長ハニカム体を被包する幅を有する）の平箔或いは波箔を導入し、その先端を各ハニカム体の外周にスポット溶接等で仮止めしてから無張力で複数巻き（2～5巻

き）巻回した後にシャーカットし、その端縁を巻回外周に接合して外被体11を形成して各ハニカム体と一体化する。しかるのちに巻取回転軸15を構成する分割片を引き抜くことによって、同径の短長ハニカム体を複数タンデムに配置したメタル担体を製造することができる。

【0018】各ハニカム体の軸方向の長さ、及びハニカム体の間隔は、得ようとする目的サイズに自由に調整でき、それに応じてスペーサーの幅も選択すればよい。

【0019】

【実施例】

【実施例1】直径90mm、長さ20mmの短長ハニカム体を各短長ハニカム体間の隙間Sを5mmとして5個連続して設けた一体型タンデム型メタル担体を作製した。ハニカム体を構成する平、波箔材は材厚み50 $\mu$ mのフェライト系ステンレスを用い、接合は拡散接合法によった。外筒ケーシングとハニカム体間に介在させたマットは、6mm厚のものを使用し、これを外筒と共に縮径して、4mmに圧縮した。外筒ケーシングは直径105mmのものが101mmに縮径された。

【0020】【実施例2】実施例1と同様の一体型メタル担体を製造した。但し、ハニカム体の平箔及び波箔の厚みのみを30 $\mu$ mにした。

【0021】【比較例1】厚さ50 $\mu$ mの箔材で直径90mm、長さ120mmのハニカム体をマット材を用いることなく外筒に挿入した従来型のメタル担体を製造した。ハニカム体の接合は拡散接合法によった。

【0022】【比較例2】直径90mm、長さ120mmの長尺シングル型メタルハニカム体を用い、その他は全て実施例1と同じ方法でメタル担体を製造した。

【0023】上記各実施例及び比較例によって製造したメタル担体を、排気量3000ccのエンジンに取り付け、HC浄化性能（BAG1）を調査した。また、同エンジンで排ガス900℃における熱-冷耐久試験を実施した。結果を表1に表す。

【0024】

【表1】

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	H C 浄化性能(BAG1) 浄化率	耐久評価
実施例 1	29%	900 サイクル合格 ハニカム損傷なし
実施例 2	37%	900 サイクル合格 ハニカム損傷なし
比較例 1	13%	900 サイクル合格 ハニカム損傷なし
比較例 2	17%	400 サイクル不合格 ハニカム内でキレツ 発生し、ずれた

## 【0025】

【発明の効果】以上のように、所望のサイズを有する短長ハニカム体を複数個直列に配置した本発明のタンデム型メタル担体は、タンデム型としての構造が極めて簡易であり、ケーシングへの組込みも各ハニカム体が一体化されているため位置決め等の作業が不要であり、しかも各ハニカム体を同時に一工程で製造できるので生産性が極めて高く、かつ安価に製造できると共に、非膨脹マツトで上記ハニカム体を保持しているため、放熱ロスがなく、他のタンデム型メタル担体に比べて、浄化性能に優れ、また、ハニカム体内での温度差がなく均一化されているためハニカム体の耐久性にも優れる。

## 【図面の簡単な説明】

【図1】本発明のタンデム型ハニカム体の一例を示す断面図。

【図2】本発明のタンデム型ハニカム体を組込んだ触媒コンバータの一例を示す断面図。

【図3】本発明の製造方法の一例を説明する図であり、(a)は設備の概要、(b)、(c)は部分説明図である。

【図4】図3より進んだ本発明の製造方法の一例を説明する図であり、(a)は設備の概要、(b)はスペーサ\*

20\*一の正面図である。

【図5】従来のメタル担体の製造説明図。

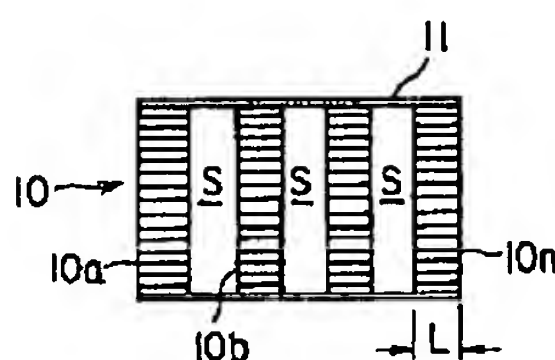
【図6】従来の他のメタル担体の製造説明図。

【図7】従来の別のメタル担体の説明図。

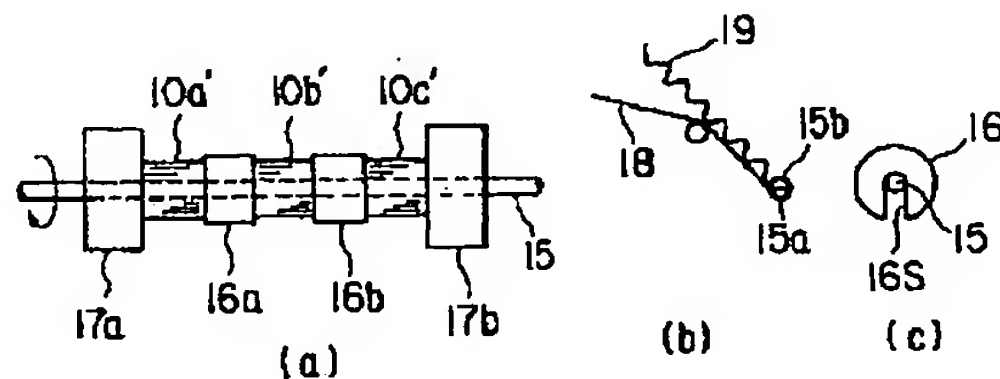
## 【符号の説明】

- 10 : 短長ハニカム体
- 11 : 外被体
- 12 : 非膨張性繊維マツト
- 13 : ケーシング
- 14 : レジューサ
- 15 : 回転軸
- 16 : 第1スペーサー
- 16s : 軸挿通溝
- 17 : 第1サイドプレス
- 17s : 軸挿通溝
- 18 : 平箔
- 19 : 波箔
- 20 : 第2スペーサー
- 20s : 第1スペーサー挿通溝
- 21 : 第2サイドプレス
- 21s : 第1サイドプレス挿通溝

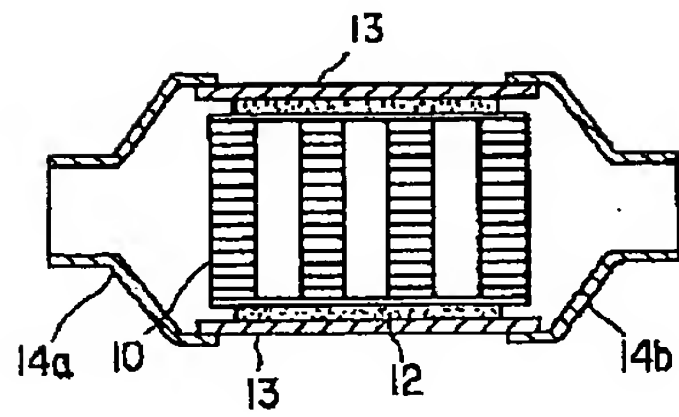
【図1】



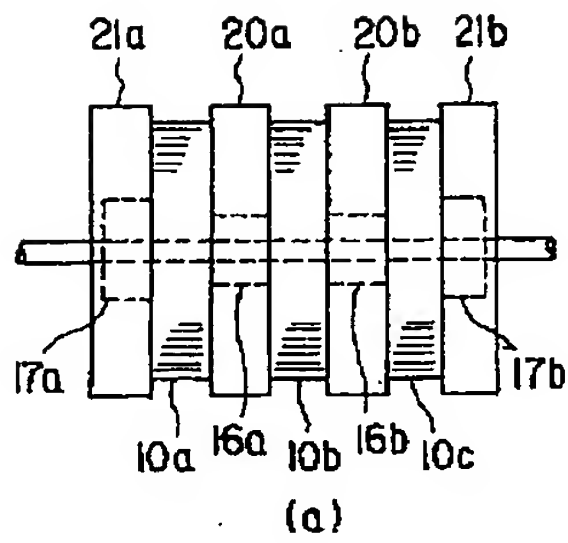
【図3】



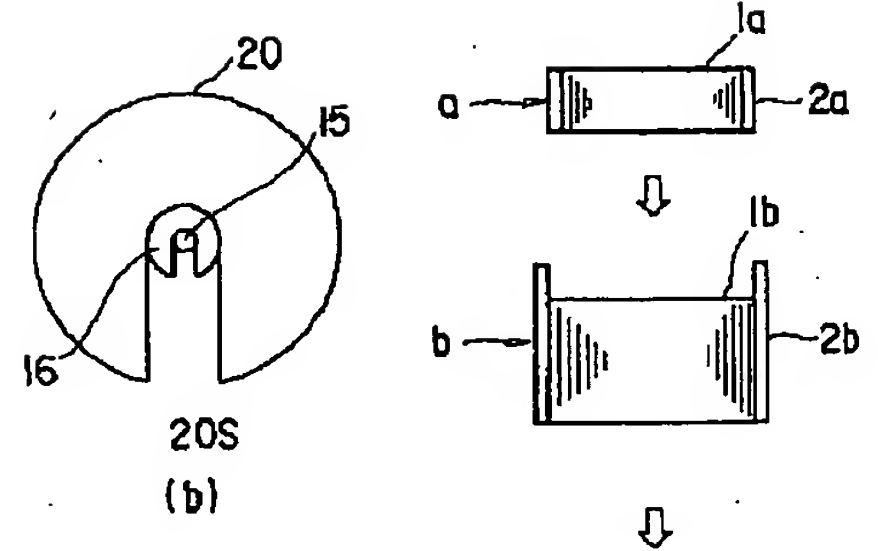
【図2】



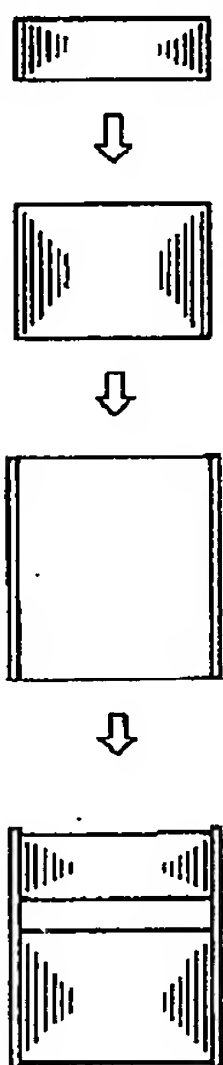
【図4】



【図5】



【図6】



【図7】

